

the present large-scale power generation system such as nuclear power generation or thermal power generation, and the manufacturing cost must be reduced.

Disclosure of the Invention

5 An object of the present invention is to provide a method of manufacturing a thin plate of silicon capable of remarkably increasing manufacturing efficiency by enlarging the production scale while ensuring high quality and extremely reducing the manufacturing cost per unit area and an apparatus for manufacturing this thin plate.

10 The inventive thin plate manufacturing method is a method of manufacturing a thin plate by dipping a surface layer part of a substrate into a melt of a substance including at least either a metallic material or a semiconductor material in a crucible arranged in a main chamber and solidifying the melt on the surface of the substrate. The substrate is loaded into the main chamber and unloaded from the main chamber through at least one subsidiary chamber adjacent to the main chamber.

15 When the atmosphere enters the main chamber having an inert gas atmosphere, silicon and oxygen react with each other if the melt is a silicon melt, for example, to cause Si loss and powder adhesion to the inner wall of the main chamber due to generation of SiO_x . It is possible to remarkably improve operating efficiency while reliably preventing introduction of the atmosphere into the main chamber or the like and
20 ensuring high quality by employing the subsidiary chamber as hereinabove described for loading/unloading the substrate through the subsidiary chamber. In other words, it is possible to directly prevent introduction of the atmosphere into the main chamber through the subsidiary chamber when loading/unloading a large quantity of substrates into/from the main chamber at high efficiency.

25 Switching means is preferably arranged between the main chamber and the subsidiary chamber in preparation for a case of an unexpected situation or the like. When the switching means is set to be closed in an emergency, the degree of trouble can be reduced. Therefore, the manufacturing yield can be improved and a high-quality

a melt in a crucible arranged in the main chamber and bonding a thin plate to the surface of the substrate, for manufacturing the thin plate by arranging a plurality of dipping mechanisms with respect to the crucible.

5 As hereinabove described, a plurality of dipping mechanisms are so employed that the time for converting a constant quantity of melt to a thin plate can be reduced.

While a first dipping mechanism included in the aforementioned plurality of dipping mechanisms performs a dipping operation, a second dipping mechanism different from the first dipping mechanism preferably performs at least one of operations of mounting the substrate, demounting the substrate to which the thin plate is bonded,
10 temperature control of the substrate and movement of the substrate.

While the time of the dipping operation rate-determining the stroke cannot be changed, the second dipping mechanism parallelly performs another prescribed operation while the first dipping mechanism performs the dipping operation so that the stroke can be reduced.

15 In every one of the aforementioned thin plate manufacturing methods, the temperature of the substrate is preferably controlled before the same is mounted on the dipping mechanism. According to this method, the stroke can be reduced for improving the operating efficiency. The temperature of the aforementioned substrate, generally controlled in the main chamber, may alternatively be controlled in the
20 subsidiary chamber.

A thin plate manufacturing apparatus according to the present invention is a thin plate manufacturing apparatus for manufacturing a thin plate by mounting a substrate on a dipping mechanism provided in a main chamber, dipping a surface layer part of the substrate in the aforementioned melt in a crucible arranged in a main chamber and
25 bonding a thin plate to the surface of the substrate. This thin plate manufacturing apparatus comprises at least one subsidiary chamber adjacent to the main chamber through switching means.

According to this structure, the atmosphere of the subsidiary chamber can be

evacuated and purged with inert gas to match with the atmosphere of the main chamber in response to introduction of the substrate into the subsidiary chamber or loading in the main chamber. Therefore, it is possible to maintain the main chamber in an inert gas atmosphere of negative pressure with high stability.

5 The thin plate manufacturing apparatus may have the aforementioned first subsidiary chamber and a second subsidiary chamber, the first subsidiary chamber may be a loading subsidiary chamber for externally introducing the substrate and loading the same into the main chamber, and the second subsidiary chamber may be an unloading subsidiary chamber for unloading the substrate to which the said thin plate is bonded
10 from the said main chamber and discharging the same. The aforementioned first and second subsidiary chambers may be provided on positions opposite to each other through the main chamber.

 According to the aforementioned structure, interference between the substrate before bonding of the thin plate and the substrate after bonding of the thin plate can be
15 prevented and the flow of the substrate can be smoothed.

 The thin plate manufacturing apparatus may further have a refilling subsidiary chamber adjacent to the main chamber through switching means for supplying a refilling raw material to the main chamber through the refilling subsidiary chamber.

 According to this structure, refilling can be performed while maintaining the
20 atmosphere of the main chamber, whereby the time between stoppage of the dipping operation for refilling and restarting of the dipping operation can be reduced.

 Another thin plate manufacturing apparatus according to the present invention is a manufacturing apparatus for manufacturing a thin plate by dipping a surface layer part of a substrate held by a dipping mechanism into a melt of a substance including at least
25 either a metallic material or a semiconductor material in a crucible arranged in a main chamber and solidifying the melt on the surface of the substrate. In this thin plate manufacturing apparatus, the dipping mechanism comprises first substrate transport means for transporting the substrate in a direction for dipping and unloading the

CLAIMS

1. A thin plate manufacturing method of manufacturing a thin plate with a dipping mechanism dipping a surface layer part of a substrate (11) into a melt (7) of a substance including at least either a metallic material or a semiconductor material in a crucible (2) arranged in a main chamber (1) and unloading said substrate by solidifying said melt on the surface of said substrate,

loading said substrate into said main chamber and unloading said substrate from said main chamber through at least one subsidiary chamber (3, 4) adjacent to said main chamber.

2. The thin plate manufacturing method according to claim 1, wherein switching means (23) is arranged between said main chamber and the subsidiary chamber, for loading said substrate into said main chamber and unloading said substrate from said main chamber along with switching of said switching means.

3. The thin plate manufacturing method according to claim 1, introducing inert gas into said main chamber while setting the pressure of the atmosphere of the main chamber to not more than the atmospheric pressure.

4. The thin plate manufacturing method according to claim 1, wherein said subsidiary chamber is constituted of a loading subsidiary chamber (3) and a unloading subsidiary chamber (4) for loading said substrate into the main chamber through said loading subsidiary chamber and unloading the substrate to which said thin plate (5) is bonded from the main chamber through said unloading subsidiary chamber.

5. The thin plate manufacturing method according to claim 2, wherein said subsidiary chamber is constituted of a loading subsidiary chamber and a unloading

said crucible.

29. The thin plate manufacturing method according to claim 20, performing temperature control of said substrate before mounting said substrate on said dipping mechanism.

30. A thin plate manufacturing method of manufacturing a thin plate by mounting a substrate on a dipping mechanism provided in a main chamber, dipping a surface layer part of said substrate into a melt in a crucible arranged in the main chamber and bonding a thin plate to the surface of said substrate, manufacturing said thin plate by arranging a plurality of dipping mechanisms with respect to said crucible.

31. The thin plate manufacturing method according to claim 30, wherein a second dipping mechanism different from a first dipping mechanism performs at least one of operations of mounting said substrate, demounting the substrate to which said thin plate is bonded, temperature control of said substrate and movement of said substrate when the first dipping mechanism included in said plurality of dipping mechanisms performs a dipping operation.

32. The thin plate manufacturing method according to claim 30, performing temperature control of said substrate before mounting said substrate on said dipping mechanism.

33. A thin plate manufacturing apparatus for manufacturing a thin plate by mounting a substrate on a dipping mechanism provided in a main chamber, dipping a surface layer part of said substrate into a melt in a crucible arranged in the main chamber and bonding a thin plate to the surface of said substrate,

comprising at least one subsidiary chamber adjacent to said main chamber through switching means.

5 34. The thin plate manufacturing apparatus according to claim 33, having a first subsidiary chamber and a second subsidiary chamber, wherein said first subsidiary chamber is a loading subsidiary chamber for externally introducing and loading the substrate into said main chamber while said second subsidiary chamber is an unloading subsidiary chamber for unloading the substrate to which said thin plate is bonded from said main chamber and discharging the substrate.

10 35. The thin plate manufacturing apparatus according to claim 34, wherein said first and second subsidiary chambers are provided on opposite positions through said main chamber.

15 36. The thin plate manufacturing apparatus according to claim 33, further having a refilling subsidiary chamber adjacent to the main chamber through switching means, for supplying a refilling raw material to the main chamber through said refilling subsidiary chamber.

20 37. The thin plate manufacturing apparatus according to claim 33, comprising substrate temperature control means on a front stage position of said substrate mounting position.

25 38. A thin plate manufacturing apparatus for manufacturing a thin plate by dipping a surface layer part of a substrate held by a dipping mechanism into a melt of a substance including at least either a metallic material or a semiconductor material in a crucible arranged in a main chamber and solidifying said melt on the surface of said substrate, wherein